Open Field Study with "Avipel Shield" Seed Treatment on Field Corn to Deter Birds from Feeding on Corn Seed and Corn Seedlings

Progress Report (2017-2018)

Ken Wise
NYS Integrated Pest Management Program
Cornell University, NYS Agricultural Experiment Station

Cooperators: Aaron Gabriel, Kevin Ganoe, Jeff Miller, Dr. Kitty O'Neil, Joe Lawrence, Paul Cerosaletti, Dale Dewing, Mike Hunter, Mike Morales and Dr. Paul Curtis.

Abstract:

Crows, ravens, black birds, starlings, grackles, Canada geese, sea gulls and wild turkeys have been a pest problem annually for corn growers in New York. Avipel Shield is a liquid seed treatment that is classified as a bio-pesticide designed to deter birds from feeding on the corn seed in a nontoxic manner. Avipel active ingredient is "anthraquinone" an extract from the rhubarb plant. These birds feed on newly planted corn seed reducing plant populations and yield in fields. In a pilot study in 2016 with farmers in Delaware County found that a bird repellent seed treatment (Avipel Shield) significantly reduced birds feeding on newly planted corn seed. We conducted a statewide study to test if it really reduced feeding by birds on newly planted corn. We planted 36 plots over 2 years and found that the product does in fact reduce feeding on newly planted corn seed by birds.

Project Description:

Crows, ravens, black birds, starlings, grackles, Canada geese and wild turkeys have been a pest problem annually for corn growers in several areas in New York State. This problem has been increasing over the last 15 years for unknown reasons. Damage to corn stands occurs when planted corn emerges and birds pull the seedling corn out of the soil to eat the seed. This damage reduces the corn plant population dramatically, negatively impacting yield. Several producers have had to replant fields due to bird damage. Bird damage many times is most extreme where soils are stony, and planting depth is shallow as a result of soil conditions. Increases in bird damage can be tied to an increased use of no-till corn planting methods, which have resulted in shallow planting depths where soil conditions have stones and compaction issues. However, damage has also been observed in fields that have received full tillage and where farmers have tried to plant deeper to deter birds. Many fields have had economic losses due to the birds feeding. Here to fore, farmers have not had easy and time efficient methods to prevent this bird damage, as planting deeper had not worked universally, nor is easy to achieve consistently, and shooting of birds (which is permissible) is not practical from a time and labor standpoint for most farms. Avipel Shield is a liquid seed treatment that is classified as a biopesticide deigned to deter birds from feeding on the corn seed in a nontoxic manner. Avipel active ingredient is "anthraquinone." This is a plant extract chemical is found in many species of plants (notably rhubarb). The company states that the birds will ingest a few of the treated seeds and it will have an unpleasant stomach reaction that causes the birds to forage of food elsewhere. Hodne-Ficher (2009) found there was less corn seed eaten by ring neck pheasants when treated with

anthraquinone vs and control of non-treated seed in newly planted corn. Scott et al. (2009) suggest that Avipel seed treatments effectively conditioned avoidance of treated seeds among Canada geese, red-winged blackbirds, and ring-necked pheasants in a laboratory study when offered corn seed treated with anthraquinone and without. The company claims that in studies it showed a statistical response to repelling Sandhill cranes to corn seed treated with anthraquinone. We conducted a pilot study in 2016 in Delaware County. The results show that the seed treatment significantly reduced feeding by birds in split field trials. On 5 farms in 5 fields the average plant population in the Avipel treated seed plots was 30,237 plants/acre. In the same non-treated hybrid, the plant population was 27,604 plant/acre. This is 2,632 more plants/acre in the Avipel treated plots than the non-treated plots. From the pilot study we prepared 2 grant proposals to conduct the same research statewide to determine how effective the product is on repelling birds. Both grants were funded (NYS Corn and Soybean Growers Association and the NYS Farm Viability Institute).
We conducted the study across Central, Northern and Eastern NY to replicate and confirm the pilot research that Avipel Shield in deterring birds from feeding on seed in newly planted corn. The research was in Schenectady, Delaware, Jefferson, Ulster, Green, Lewis, Oneida and Franklin Counties in 5 to 10-acre fields.

Methods and Procedures:

Goal: On-farm research was conducted with Avipel Shield seed corn treatment in fields that traditionally have excessive bird damage in newly seeded field corn that will help maintain planted plant populations and higher yields than fields without the seed treatment over a growing season

We worked cooperatively with 9 extension educators/specialist that have organized 11 farms to participate in this on-farm research trial. Each farm was supposed to identify 2 fields that were less than 10 acres to plant in a side by side split block design. The extension educators worked cooperatively with farmers to plant the treatments. Each field received 1 bag of treated corn seed and 1 bag on non-treated corn in a random split block design. (about 2.5 acre blocks side by side in each field) The treated and non-treated was a 97day multi-purpose hybrid from Dairyland (HiDF 3197RA) to reduce other possible variables interfering with the research. Once the blocks were established the rest of the field was planted to the grower's normal hybrid.

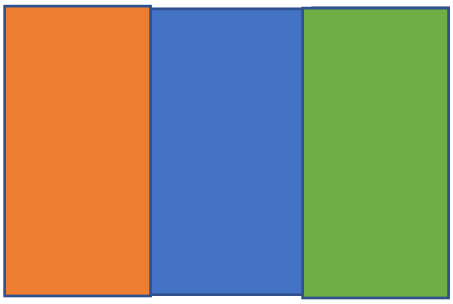
Research Protocol: At PLANTING

1. Select a field with past bird issues at seeding
2. Preferably the field should be small (5 to 10 acres)
3. Each field will be planted in a split block design.
4. Each field will receive 1 bag of treated corn seed and 1 bag on non-treated corn in a random split block design. (2.5 acre blocks side by side in each field) Randomly select whether the Avipel treatment will be left or right in a field by flipping a coin.
5. Once the blocks have been planted the rest of the field will be planted to the grower's normal hybrid. Preferably each plot should contact the edge of the field. If possible, the plots should be orientated in a way that have equal access to the closest or primary roosting area for birds.

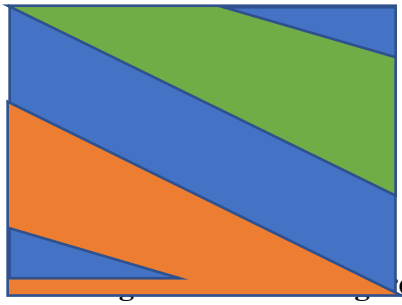
Examples:

Blue = Farmer's hybrid: Orange = Seed Treated with Avipel: Green = Seed with No Avipel

Roosting area/Trees



Roosting area/Trees/Hedgerow



Roosting area/Trees/Hedgerow

Note: that we do understand some of the limitations of getting plot areas equally represented to roosting areas. The main goal is to get all the plots planted in a way that will fit what the grower has planned.

Data Collection:

<u>Plant populations</u>

1. Once the blocks are planted data will be collect on each of the treatments at the V3 stage of growth

2. Take 2 randomized samples in each of 4 quadrants of each treatment and non-treatment plot area. Counting plant populations in each of the quadrants will be taken at 100 feet lengths in 2 rows next to each other.
3. Please make any other observations on damage and attempt to determine what species of birds is doing most of the injury. Weekly observations up to V3 would helpful to determine what birds are in the fields and document the damage with photos.
4. Please coordinate with the grower to measure yield on each treatment. Measure yield by bushel of corn or tons of silage per acre, whichever the farmer is harvesting.
5. Other factors to be collected as data
    - Date Planted
    - Sample Date
    - What is the soil type?
    - What birds are feeding on corn?
    - Record areas of damage with photos and GPS

<u>Yield Measures</u>

6. Silage
    - Use scales and wagons/trucks to measure the wet plant weight of the entire treatment area (~2.5 acres)
    - Hand Sampling: 5 locations in each treatment block, cut a 20' row length at 10" above the soil surface. Weigh whole plant sample
7. Grain
    - Use yield monitor to determine bushels/acre

Each extension educator conducted plant population counts in each of the non-treated and treated blocks. Plant population counts were conducted V3 stage of growth. They also will make other observations on whether birds were an issue, what species of birds were in the fields, other plant health issues like diseases, insect pests weather-related occurrences, etc.

At the end of the season yield measurements were conducted on each treatment. The Extension educator worked cooperatively with farmers to conduct a yield assessment (grain or silage) in each of the treatments.

At the completion of the season we ran a data analysis of the on-farm research on the treatments vs the control. We conducted a sign-test on the plant populations and a Wilcox test on the yield.

Results:

Because of storms and wet weather and coordination with farmers in 2017 we planted 18 of the 22 fields with the side by side plots. Wet weather early in the season caused some farmers not to be able to plant the plots. We also lost two fields to an extreme weather event that washed out most of the plot areas. We ended with 16 plots that we conducted plant populations. Figure 1 depicts the plant populations in relative to the treatment vs control. The Avipel did have a higher plant population than the control and was significantly different using a sign-test (p.01). Over all the Avipel plots had 612 more plants/acre that the control with the as high a range as 3116 plants/acre in Avipel treated plants vs the control in a single field.

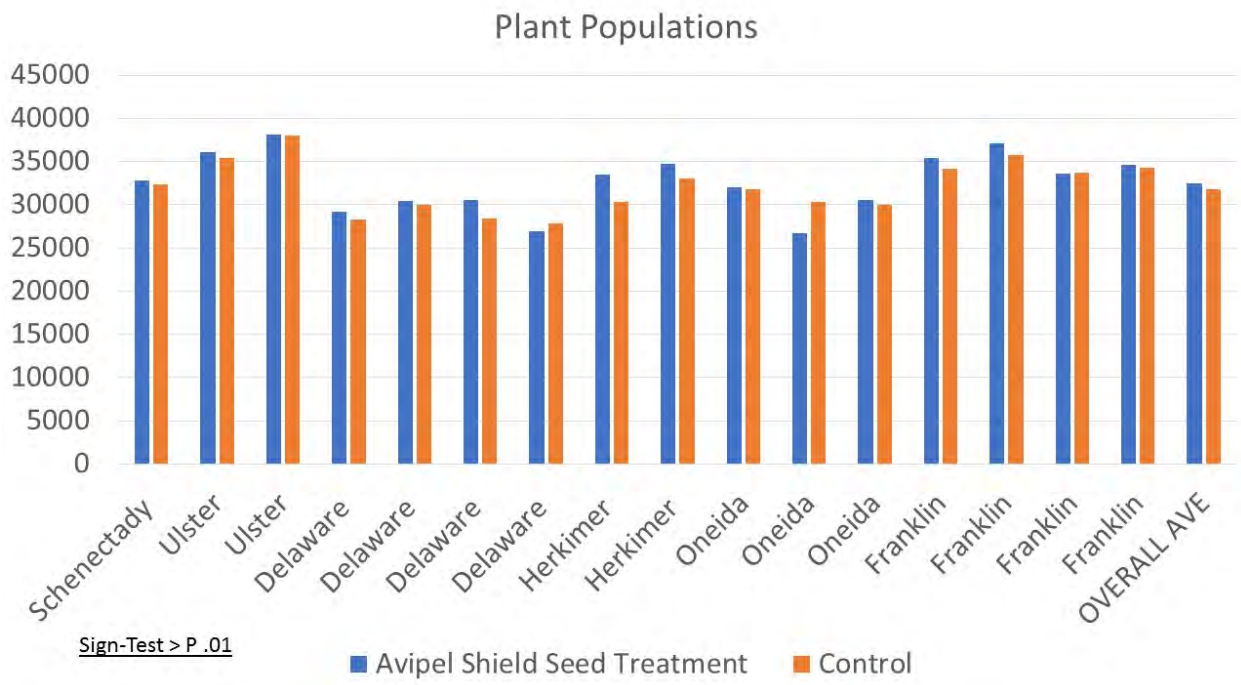


Figure 1: 2017 Plant populations of the Avipel treated seed vs a control.

In 2018 we planted 20 fields to the side by side Avipel vs control. We collected plant populations at the V3 stage of growth and attempted to identify the bird species in the fields. Figure 2 depicts the difference between the Avipel treated plots vs the control. The Avipel did have a higher plant population than the control and was significantly different using a sign-test (p.01). Over all the Avipel plots had 962 more plants/acre that the control with the as high a range as 4397 plants/acre in Avipel treated plants vs the control in a single field.

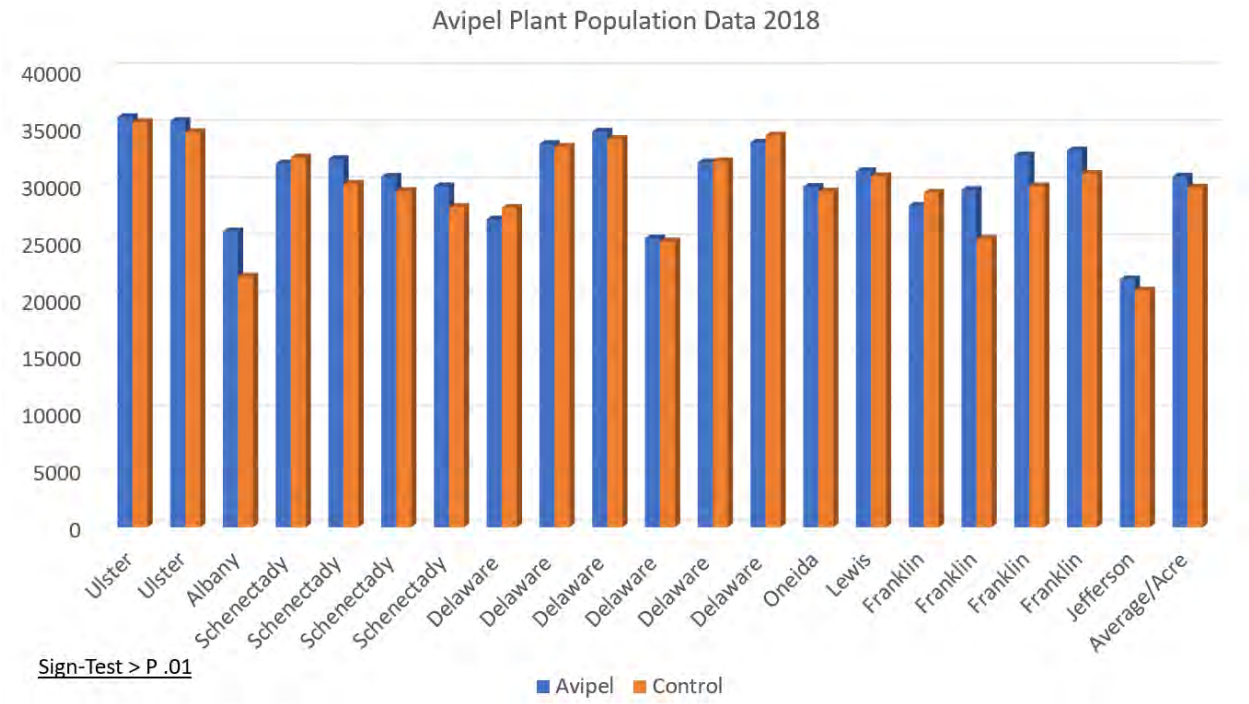


Figure 2: 2018 plant populations of the Avipel treated seed vs a control.

When you pool the data for 2017 and 2018 the difference between the Avipel treated plot and the control was highly significate at a *P* value of .001. Figure 3 shows the plant population difference of 777 plants to the advantage of the Avipel treated seed.

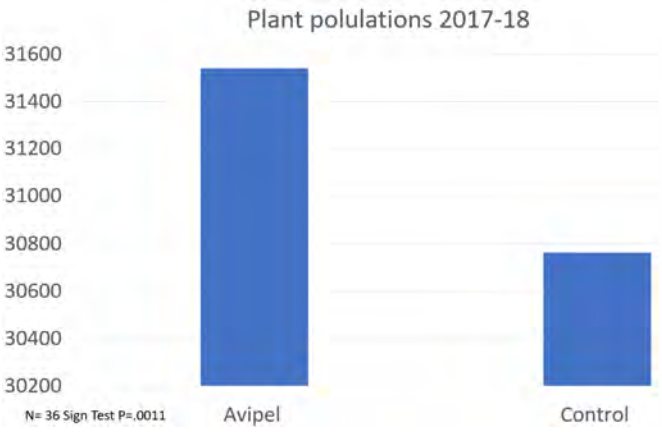


Figure 3: Combined overall plant populations of the Avipel treated seed vs a control.

This indicates that Avipel did repel the birds and help establish the field. Note that many of the fields did not have heavy bird pressure. If the pressure was higher, the difference may have been

more dramatic. In fields that did have a lot of pressure, the Avipel did result in more a difference between the treatment and control, especially in fields that had gravel or stony soil.

In 2017 we collected yield data on 11 of the 18 fields. There were some coordination issues with the cooperating growers and extension educators on the remaining fields. The results do not show any significate differences between the Avipel and control in silage or grain yields (Figure 4).

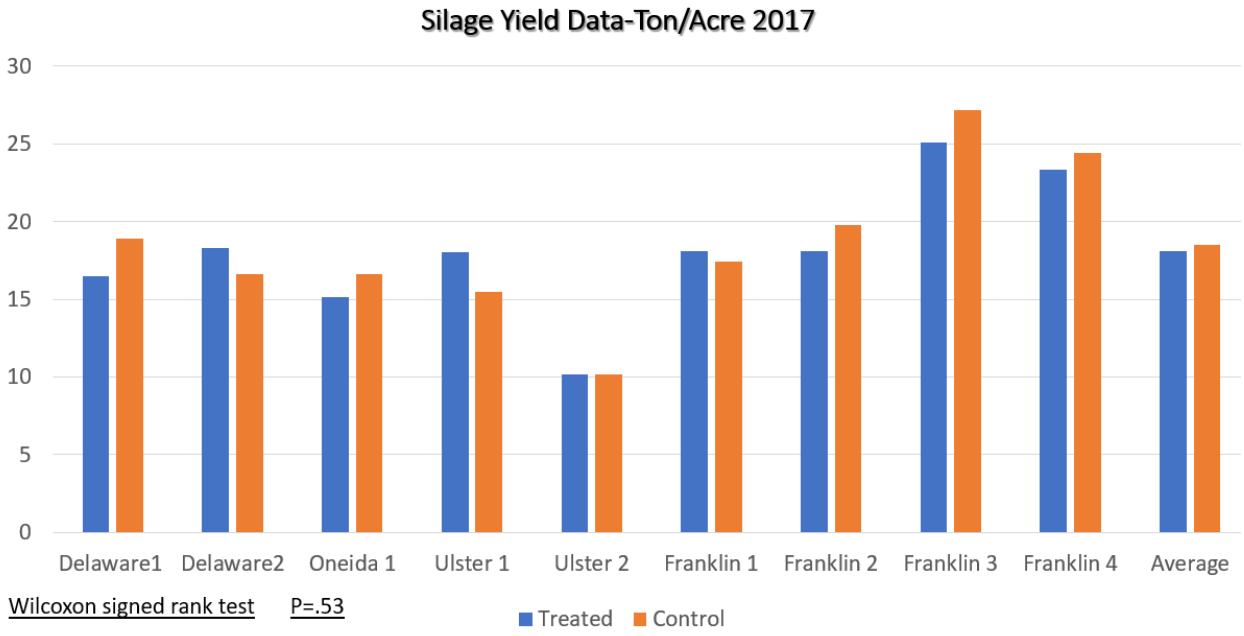


Figure 4: 2017 Silage yield of Avipel vs control.

In 2018 we collected silage yield on 6 fields. Due to excessive rain in the fall, many of the cooperating growers decided to wait for adequate field conditions for a late harvest. This eliminated the option for much of the silage to be harvested. The results do not show any significant differences between the Avipel and control in silage or grain yields (Figure 5).

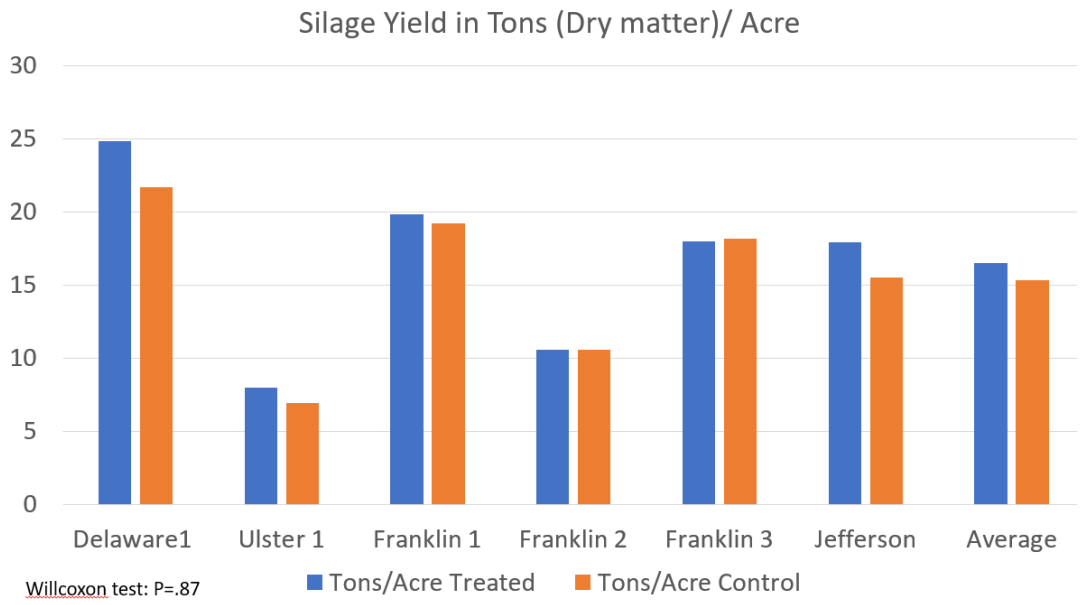


Figure 5: 2018 Silage yield of Avipel vs control.

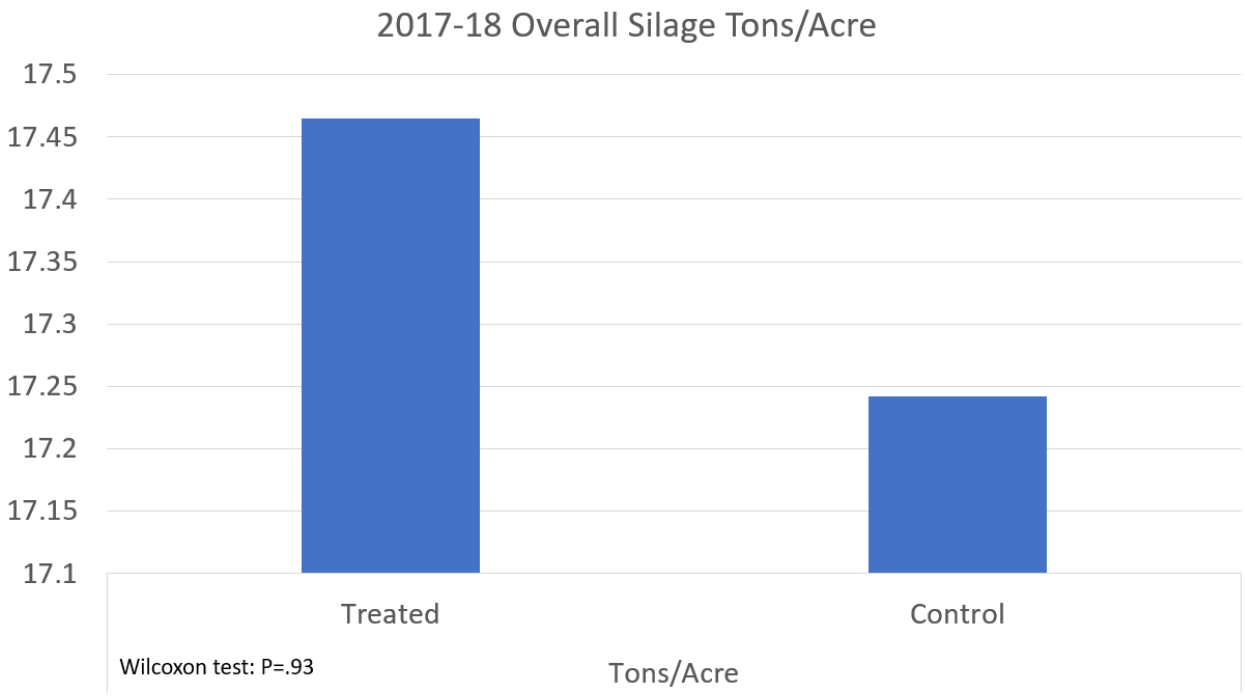


Figure 6: Combined overall plant populations of the Avipel treated seed vs a control.

We collected grain yield on 2 plots in 2017 and 2 plots in 2018. This was not enough data to run a statistical measure. Yield may not be the best measure for evaluating Avipel as is conducting plant populations. In both years with the excess amount of rain, it was difficult to arrange when the growers were going to harvest since there was only short windows to proceed. The purpose of the product is to keep birds from feeding on the newly planted corn seed.

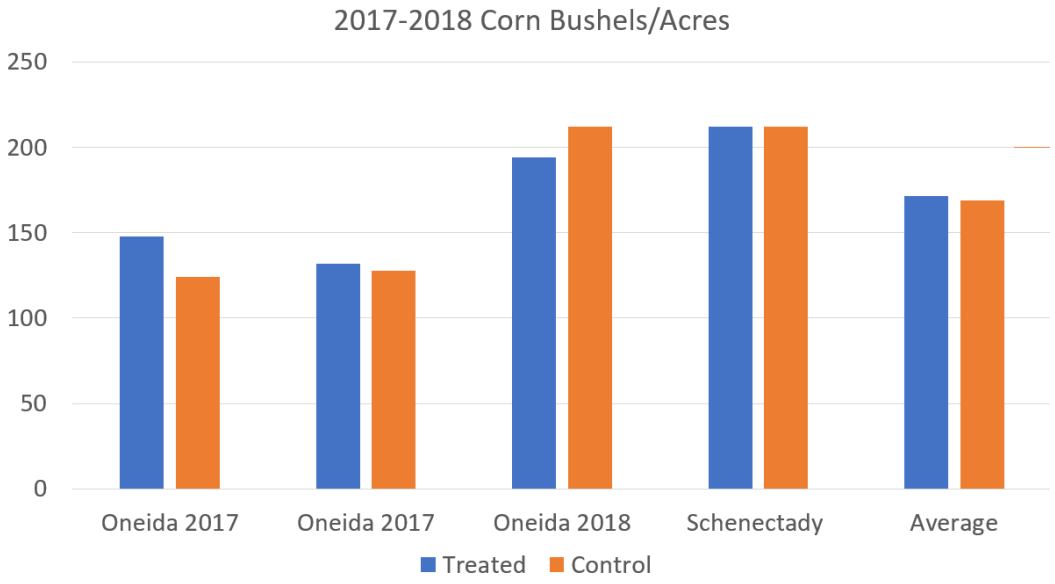


Figure 7: Grain yield of Avipel vs control

Note that many factors go into the end of the season yields of field corn. It is thought that the growing condition and other environmental factors most likely effected yield in this research in 2017-18.

Impacts:

In this study, crows were the main pest observed in the fields feeding on newly planted corn seed. There were also turkeys, seagulls and red winged black birds observed. It is thought that crows and other birds learn the effect of the product, and most likely do not come back to those fields in the following years.

The main impact of this research is the Avipel helped maintain plant population in fields. In fields with heavy bird pressure it did very well in maintaining the plant populations. Birds, mostly crows, are complicated in how they select where they want to roost and feed from year to year. With the pilot study in 2016, and the 2017-18 data, it seems that Avipel does help repel birds from feeding on newly planted corn. Some of the growers in this project planted all their corn with Avipel because they stated that they had their best yield in years. It may be that there is an effect within the same field where Avipel is planted next to the non-treated seed. It may be that the birds would completely leave the fields after experiencing the Avipel.

Project Outreach:

We presented the 2017-18 results to farmers, crop consultants, extension educators and more in a several venues including field meetings, crop congresses, field crop dealer meeting, certified crop advisors training, agriculture in-service training, and more.

Thank you for all the work the Extension Educators did in this project: Aaron Gabriel, Kevin Ganoe, Jeff Miller, Mike Hunter, Dr. Kitty O'Neil, Joe Lawrence, Paul Cerosaletti, Dale Dewing and Dr. Paul Curtis. This work would not have been completed without them!